SCIENCE

[Entered at the Post-Office of New York, N.Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

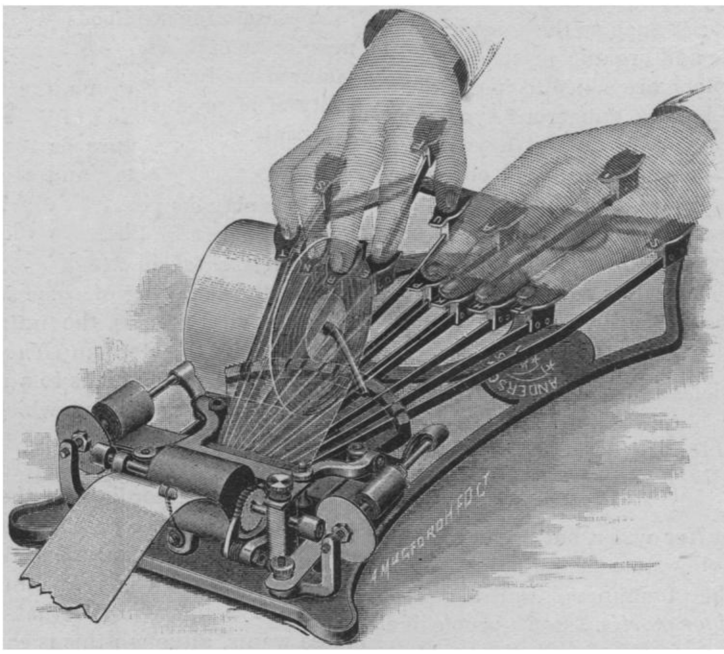
EIGHTH YEAR.
VOL. XV. No. 375.

NEW YORK, APRIL 11, 1890.

SINGLE COPIES, TEN CENTS.
$3.50 PER YEAR, IN ADVANCE.

A SHORTHAND TYPE-WRITER.

A VERY ingenious piece of mechanism, intended to lighten the labor of the shorthand reporter, is shown in the illustration on this page. It is the invention of Mr. G. K. Anderson of Boston, and is known as the shorthand type-writer. As its name indicates, it is an adaptation of the principle of the type-writer to an instrument for recording, in legible characters, the words of a speaker as fast as they may be uttered. It is claimed by its inventor that an operator of ordinary dexterity and intelligence will be able to write from dictation, with this instrument, at the rate of a hundred words per minute after only five or six weeks' practice. It is also claimed that from two hundred to two hundred and fifty words may be printed on this machine with the same number of strokes required to print forty or fifty on an ordinary type-writer.



THE ANDERSON SHORTHAND TYPE-WRITER.

The printing is done on a continuous strip of paper, similar to that used in the printing telegraph or the stock quotation "ticker." After each impression, which may be made by only one key, or by all the keys at once, or by any combination of keys, the paper is moved forward automatically, ready for the next impression. The key-board contains only the most frequently used letters in the alphabet, the other letters being represented by certain arbitrary combinations of those on the board.

SALADS.

AT the fortnightly meeting of the Royal Horticultural Society recently, M. Henri de Vilmorin, president of the Botanical Society of France, delivered a lecture on salads, mentioning that in England the people neither eat nor grow so many plants for salad as in France. He dwelt, says *Nature*, upon the nutritive value of salads due to the potash salts, which, though present in vegetables generally, are eliminated in the process of cooking. He then enumerated the various plants which are used in salads in France; namely, the leaves of lettuce, corn-salad, common chiccory, barbe de capucin, curled and Batavian endives, dandelion in its several forms of green, blanched, and half-blanched, water-cresses, purslane in small quantities, blanched salsify-tops of a pleasant nutty flavor, witloof or Brussels chiccory, the roots of celeriac, rampion, and radish, the bulbs of stachys, the stalks of celery, the flowers of nasturtium and yucca, the fruit of capsicum and tomato, and, in the south of France, rocket, picridium, and Spanish onions. Various herbs are added to a French salad to flavor or garnish it, such as chervil, chives, shallot, and borage flowers. In addition, many boiled vegetables are dressed with vinegar and oil. M. de Vilmorin then showed specimens of dandelion, barbe de capucin, and witloof, both varieties of chiccory, which he recommended to the notice of English gardeners as most useful and palatable. He mentioned that from a ton to a ton and a half of witloof is daily carried to the Paris market from Brussels, where it is grown in the greatest perfection. Specimens of English salads grown in the month of March, and consisting of corn-salad, lettuce, and blanched chiccory, were sent from the Marquis of Salisbury's gardens at Hatfield. Among the other exhibits was a quaint orchid (*Cœlogyne pandurata*), a native of Borneo, sent from Kew Gardens. The flower is bright green, like the color of forced lilac-leaves, with a dull jet-black blotch and lines on the lip.

FOODS AND FOOD ADULTERANTS.

THERE is hardly any subject with which we come into such daily and constant contact as that of food, about which there is so much ignorance and prejudice; and it is the purpose here to discuss the nature, properties, and some of the chief adulterants of the principal food-products in regard to their healthfulness and composition from a chemical standpoint.

There has been a large amount of information published in periodicals, official reports, general and monograph volumes, written in English, French, German, and other languages;[1] which, however, has not found its way to the general public, who, as a rule, have a feeling of uncertainty and insecurity on the subject of most food-products. When people hear that a certain food is adulterated, or is a food substitute, there is immediately a prejudice excited against the article, which it takes time and familiarity to allay, because they imagine that any substance used as an adulterant of, or a substitute for, a food-product, is to be avoided as being injurious to health. A moment's reflection ought to show that it would be directly contrary to the food-manufacturer's interest to add to, or substitute any thing for, a food-product which would cause injurious symptoms, as in that case his means of gain would be cut off by the refusal of consumers to buy his product. It is true that the unscrupulous manufacturer or dealer does not hesitate to cheat his customer in the interest of his own pecuniary profit and gain, but he does not want to poison him. Where, through carelessness or ignorance, injurious substances, such as the arsenic, copper, aniline, and other metallic and organic poisonous salts sometimes used for artificial colors, are added to foods, their presence is promptly revealed by the dangerous symptoms which they call forth in the consumer. About a year ago the case of the Philadelphia bakers, who added chromate of lead to color some of their cakes, and thus caused the death of several persons, and serious illness in nearly every one who ate any of these products, will be recalled by many.

Prejudice about Foods.

How much this nearly universal prejudice arises from misleading and sensational articles and advertisements in the daily newspapers, it would be hard to say. That a large proportion of the articles suitable for food, and produced in all countries, is wasted annually because of this prejudice, is undoubtedly true.

We do not object to eating a *live* oyster, but prefer all our other meats *dead*, and undergoing putrefaction to a slight extent, in order to get rid of the "toughness," as it is generally called, produced by the *rigor mortis*. Some people like to let the putrefaction proceed further until the meat is "gamy." The Texan cowboy eats goat's meat in preference to that of the cattle and sheep he is herding. Young puppies, rats, and birds' nests are considered delicacies by the Chinese. Frogs' legs and snails are among the highest priced dishes served at Delmonico's. Except the bones and hide, every part of an animal slaughtered for food is eaten by most civilized nations,—the brain; tongue; blood in the shape of black pudding and sausages; the liver; heart; lungs; stomach as tripe; the pancreas, thyroid, and sublingual glands, which are called sweetbreads, and considered a great delicacy; the feet in the way of jellies, and pickled; the intestines as sausage covering, etc. In the markets of Paris there is a steady demand for horse-flesh as food. The Arabs and other nomadic tribes prefer mare's or camel's to cow's milk. Many people would as soon eat a snake as an eel, yet the latter commands a higher price than most fish in many parts of the world. Lobsters, which are the scavengers of the sea, are eaten by people who would not touch pork. The Eskimo, who eats blubber and other solid fats, and the native of the tropics, who "butters" his bread with a liquid vegetable oil, have the same object in view; viz., to supply a concentrated form of fuel. The squirrel is considered a great delicacy in many parts of this country, but is not eaten in England. The vain efforts of Professor Riley some years ago to induce the starving people of Kansas to eat the food they had at their doors,—grasshoppers, sorghum and millet seeds, and squirrels,—himself setting them the example, will be recalled by many.

Our bodies are like a furnace, and require fuel and air to sustain the heat of combustion by the constant renewal of fresh material and the elimination of the waste products. The form, whether solid or liquid, of animal or vegetable origin, in which we supply this fuel, depends largely on local circumstances, climate, education, etc.; and, as long as the food employed goes to furnish the proper amount of fuel material for the maintenance of the body temperature, life is sustained.

The extent of the consumption of any new food will evidently depend on how it fulfils this requirement as a fuel, and by its pleasing appearance, its palatability, its capacity to appease hunger, its wholesomeness, and its relative cheapness, attracts public attention. If the new food is a manufactured product, its cheapness will depend upon the possibility of its production on a large scale from relatively cheap materials.

Classification of Foods.

Foods may conveniently be divided into two large divisions,—the first and chiefest, that which the Germans call *Nahrungsmittel*, in which the article of food supplies material for the renewing of some structure or the maintenance of some vital process, the nutrients; and the second, well expressed by the German *Genussmittel*, in which the food increases the vital actions to a much greater degree than the amount of nutritive value which it supplies would lead one to suppose, the stimulants.

These two divisions can again be subdivided into five different classes, according as they supply moisture, nitrogenous material, fats, carbohydrates, and mineral salts. A combination of all five in certain proportions will supply the whole wants of the body, or, in other words, make a perfect food. It is not essential that one food should supply all these wants, although this is eminently the case in regard to young infants, where the mother's or other milk contains the proper proportions of all five classes; but it is essential that it should supply one or more of these materials, so that, by judicious combinations of a variety of different foods, the proper amount of nourishment may be supplied.

This classification could be extended much further, into simple, compound, easily digested, economical, agreeable, flesh-forming and heat-forming, sweet, acid, etc.

Chemical Composition of the Human Body.

Before proceeding further, let us see what is the chemical composition of a human body, so that we may have some idea of what kind of material the food consists which is to support or increase its vital action.

An interesting collection will be found in some cases in

[1] In the report of the Commissioner of Internal Revenue for 1888, pp. xi-xxiii, will be found a short bibliography of the leading publications, prepared by the writer.

the United States National Museum at Washington, showing the approximate weights of the chemical elements found in the body of a man five feet eight inches high, weighing one hundred and forty-eight pounds (Table I.). It is obvious that the composition of the bodies of different persons will vary with age, size, sex, stoutness, etc.; so that the figures given in the following table can only be considered typical.

Table I.—Chemical Composition of the Human Body (calculated by Professor W. O. Atwater).

Elements.	Pounds.	Per Cent.	Compounds.	Pounds.	Per Cent.
Oxygen	92.40	62.4	Water	90.0	60.6
Carbon	31.30	21.2	Proteine	26.6	18.2
Hydrogen	14.60	9.9	Fats	23.0	15.5
Nitrogen	4.60	3.1	Carbohydrates	0.1	0.1
Calcium	2.80	1.9	Mineral matters	8.3	5.6
Phosphorus	1.40	0.9			
Potassium	.34	0.6			
Sulphur	.24				
Chlorine	.12				
Sodium	.12				
Magnesium	.04				
Iron	.02				
Fluorine	.02				
Total	148.00	100.0	Total	148.0	100.0

We find in the above table, that, when the innumerable organic and inorganic compounds of which our bodies are composed are reduced to the simple form of their chemical elements, they can be divided into three groups: first, gases (oxygen, hydrogen, nitrogen, chlorine, and fluorine,—five); second, solids, non-metals (carbon, phosphorus, and sulphur, —three); and, third, solids, metals (iron, calcium, magnesium, potassium, and sodium,—five). Besides these thirteen elements, minute quantities of a few others, as silicon, manganese, and copper, are found in the body.

The principal materials of which the body is composed may be briefly stated as follows. The flesh (muscles) consists of water, fat, inosite, fibrine, albumen, myosin, gelatine, certain extractives, and salts of lime, magnesia, potash, soda, iron, and phosphorus. Blood is in composition very similar in its elements to that of flesh. Bone, of which about 30 per cent is mineral matter composed of salts of lime, magnesia, potash, soda, and phosphorus, contains cartilage, gelatine, and fat. Cartilage consists of collagen and other gelatinoids, with salts of soda, potash, lime, magnesia, iron, phosphorus, and sulphur. The brain, nerves, and spinal cord contain substances called protagon, cerebrin, etc., consisting of nitrogenized and phosphorized fats, also water, and mineral salts. The liver is formed of water, fat, glycogen, and albuminoids, besides salts of potash, soda, lime, iron, and phosphorus. The lungs consist of gelatinoids and albuminoids, fibrine, various fatty and organic acids, cholestrin, and salts of soda and iron, and water.

Chemical Composition of Different Foods.

It will seem strange to many that substances seemingly as dissimilar as flesh and wheat should contain the same class of chemical elements; yet in both we find water and mineral salts, nitrogenous materials, fats, and carbohydrates, as Table II. shows.

Proteine.

The most important class of food-material is that containing nitrogen, which is usually present in the form of albuminoids; i.e., organic substances very similar in chemical composition to albumen or "white of egg," or in the form of gelatinoids, i.e., organic substances similar to gelatine in chemical composition; and it is customary for chemists to call both by the generic name of "proteine." Lean meat, the curd of milk, and the gluten of wheat, consist principally of proteine compounds. The "extractives," as chemists call the organic compounds, containing nitrogen, which are extracted from flesh by treatment with water,—beef-tea, extract of beef, etc.,—are interesting, in that they act as stimulants, like alcohol, and are not nutrients. The other two organic classes of foods, which, however, do not contain nitrogen, are the fats and the carbohydrates.

Fats.

The fats contain the chemical elements, carbon, hydrogen, and oxygen, and are known as the glycerides of the fatty

Table II.—Average Chemical Composition of Different Food-Materials.[1]

Food-Material.	In the Original Substance.					In the Dried Substance.			
	Water.	Proteine.[2]	Fat.	Carbohydrates[3]	Ash.	Proteine[2]	Fat.	Carbohydrates[3]	Ash.
Ox, flesh, very fat	53.05	16.75	29.28	—	0.92	35.68	62.37	—	1.95
" " medium fat	73.03	20.96	5.41	0.46	1.14	77.59	20.03	0.16	4.22
" " lean	76.37	20.71	1.74	—	1.18	87.65	7.16	—	5.19
" fat, heart	65.66	19.61	13.75	0.10	0.88	57.10	40.04	0.30	2.56
" lungs	81.03	12.37	2.46	0.21	3.93	65.21	12.97	1.10	20.72
" liver	71.39	19.72	5.55	1.69	1.65	68.92	19.40	5.91	5.77
Cow, flesh, fat	70.96	19.86	7.70	0.41	1.07	68.40	26.52	1.39	3.69
" " lean	76.35	20.54	1.78	0.01	1.32	86.84	7.53	0.05	5.58
Calf, " fat	72.31	18.88	7.41	0.07	1.33	68.17	26.76	0.27	4.80
" " lean	78.84	19.86	0.82	—	0.50	93.86	3.88	—	2.26
Mutton, " very fat	53.31	16.62	28.61	0.54	0.93	35.60	61.28	1.13	1.99
" " medium fat	75.99	17.11	5.77	—	1.33	71.26	23.20	—	5.54
Hog, " fat	47.40	14.54	37.34	—	0.72	27.64	70.98	—	1.38
" " lean	72.57	20.25	6.81	—	1.10	73.83	24.83	—	1.34
Horse "	74.27	21.71	2.55	0.46	1.01	84.39	9.91	1.77	3.93
Blood	80.82	18.12	0.18	0.03	0.85	94.48	0.94	0.15	4.43
Salmon	64.29	21.60	12.72	—	1.39	60.48	35.63	—	3.89
Mackerel	71.20	19.36	8.08	—	1.36	67.23	28.05	—	4.72
Shad	70.44	18.76	9.45	—	1.35	63.47	31.97	—	4.56
Oysters, flesh	80.52	9.04	2.04	6.44	1.96	46.41	10.47	43.05	10.07
" liquor	95.76	1.42	0.03	0.70	2.09	33.49	0.71	16.51	49.29
" flesh and liquor	87.30	5.95	1.15	3.57	2.03	46.85	9.06	28.11	15.98
Woman's milk	87.41	2.29	3.78	6.21	0.31	18.19	30.02	49.33	2.46
Cow's "	87.17	3.55	3.69	4.88	0.71	27.67	28.74	38.06	5.53
Goat's "	85.71	4.29	4.78	4.46	0.76	30.02	33.45	31.21	5.32
Sheep's "	80.82	6.52	6.86	4.91	0.89	34.00	35.77	25.59	4.64
Butter	13.59	0.74	84.39	0.62	0.66	0.86	97.64	0.74	0.76
Oleomargarine	10.57	—	85.82	1.14	2.47	—	95.95	0.73	3.32
Cheese, full cream	38.00	25.35	30.25	1.43	4.97	40.89	48.79	2.30	8.02
" whole milk	39.79	29.67	23.92	1.79	4.73	49.23	39.68	3.24	7.85
" skimmed milk	46.00	34.06	11.65	3.42	4.87	63.08	21.58	6.32	9.02

[1] König's Chemie der menschlichen Nahrungs- und Genussmittel (Berlin, 1889), vol. i. p. 1100 *et seq.*
[2] Nitrogenous substances. [3] Nitrogen free substances.

Table II.—Continued.

FOOD-MATERIAL.	In the Original Substance. Water.	Pro-teine.[1]	Fat.[2]	Sugar.[2]	Dex-trine.[2]	Starch.[2]	Crude Fibre.	Ash.	In the Dried Substance. Pro-teine.[1]	Fat.[2]	Sugar.[2]	Dex-trine.[2]	Starch.[2]	Crude Fibre.	Ash.
Wheat, kernel	13.37	12.04	1.85	3.25	2.54	62.86	2.31	1.78	13.89	2.13	3.87	2.93	72.46	2.67	2.05
Chaff	13.37	11.84	1.85	0.98	1.74	65.52	2.65	2.07	13.66	2.13	1.13	1.98	75.65	3.06	2.39
Rye	13.37	10.81	1.77	1.87	4.57	63.77	1.78	2.06	12.47	2.04	2.16	5.27	73.63	2 05	2.38
Barley	14.05	9.66	1.93	1.23	3.75	62.01	4.95	2.42	11.23	2.24	1.43	1.36	72.17	5.76	2.81
Oat	12.11	10.66	4.99	1.72	1.89	54.76	10.58	3.29	12.13	5.68	1.96	2.15	63.30	12.01	3.74
Maize, corn	13.35	9.45	4.29	2.29	2.06	64.98	2.29	1.29	10.90	4.95	2.64	2.38	75.00	2.61	1.19
Rice, hulled	12.58	6.73	0.88	0.15	0.77	77.56	0.51	0.82	7.70	1.01	0.17	0.88	88.72	0.58	0.94
Buckwheat	14.12	11.32	2.61		54.86		14.32	2.77	13.18	3.04		63.88		16 68	3.22
Wheaten flour, fine	13.37	10.21	0.94	2.35	3.06	69.30	0.29	0.48	11.79	1.08	2.71	3.53	80.01	0.33	0.55
" " coarse	12.81	12.06	1.36	1.86	4.09	65.88	0.98	0.96	13.83	1.56	2.13	4.69	75.57	1.12	1.10
" grits	13.05	9.43	0.94		75.92		0.21	0.40	10.84	1.08		87.38		0.24	0.46
Rye-flour	13.71	11.57	2.08	3.89	7.16	58.66	1.59	1.44	13.41	2.41	4.51	8.30	68.06	1.84	1.67
Barley-flour	14.83	11.38	1.53	3.11	6.52	61.60	0.45	0.59	13.36	1.80	3.65	7.65	73.82	0.53	0.69
Oatmeal	9.65	13.44	5.92	2.26	3.08	61.67	1.86	2.12	14.88	6.55	2.51	2.41	69.24	2.06	2.35
Cornmeal	14.21	9.65	3.80	3.56	3.36	62.63	1.46	1.33	11.21	4.42	4.14	3 90	72.81	1.97	1.55
Rice flour	12.82	6.91	0.67		78.84		0.18	0.58	7.93	0.77		90.42		0.21	0.67
Buckwheat-flour	13.51	8.87	1.56	1.06	2.95	70.30	0.67	1.14	10.25	1.80	1.23	3.41	81.25	0.78	1.28
Wheaten bread, fine	35.59	7.06	0.46	4.02	52.56		0.32	1.09	10.95	0.71	6.24	79.91		0.50	1.69
" " coarse	40.45	6.15	0.44	2.08	49.04		0.62	1.22	9.71	0.69	2.28	84.41		0.98	1.93
" biscuit	13.28	8.55	0.98	1.82	73.28		0.59	1.50	9.86	1.13	2.10	84.50		0.68	1.73
Rye bread	42.27	6.11	0.43	2.31	46.95		0.49	1.46	10.58	0.74	4.00	81.30		0.85	2.53
Oat biscuit	13.04	8.39	6.03	4.09	60.12		5.28	3.05	9.65	6.93	4.70	69.14		6.07	3.51
Potato	74.98	2.08	0.15	0.28	20.73		0.69	1.09	8.31	0.60	1.12	82.85		2.76	4.36
Sweet-potato	82.52	1.78	0.14		14.04		0.64	0.88	9.12	0.72		82.37		3.28	4.51
Swedish turnip	87.80	1.54	0.21	2.71	5.51		1.32	0.91	12.62	0.25	3 24	81.22		1.58	1.09
Turnip	90.78	1.18	0.22		5.89		1.13	0.80	12.80	2.39		74.90		1 23	8.68
Beet	87.50	1.34	0.14	7.22	1.68		0.98	1.14	10.72	1.12	57.76	13.44		7.84	9.12
Sugar-beet	82.25	1.27	0.12	12.52	1.88		1.14	0.82	7.22	0.68	71.16	9.80		6.48	4.66
Carrot, large variety	86.79	1.23	0.30	6.71	2.46		1.49	1.02	9.31	2.27	50.79	18.63		11.28	7.72
" small "	88.84	1.07	0.21	1.58	6.59		0.98	0.73	9.59	1.88	14.16	59.05		8.78	6.54

[1] Nitrogenous substances. [2] Nitrogen free substances.

acids. The fats, of which there are many kinds, both animal and vegetable, may be said to be mixtures of three typical forms,—the solid variety, stearine, found in almost every animal and vegetable fat; the semi-solid form, palmitin, found especially in palm-oil, whence its name; and the liquid, oleine, found in olive-oil, human fat, etc.

Carbohydrates.

The carbohydrates contain the same chemical elements as the fats, but in different proportions, and are represented by sugar and starch in the vegetable, and by liver-sugar, glycogen, and muscle-sugar, inosite, in the animal kingdom.

The average composition of these three organic classes of foods may be given as follows:—

	Carbon. Per Cent.	Hydrogen. Per Cent.	Oxygen. Per Cent.	Nitrogen. Per Cent.	Total.
Proteine	53.0	7.0	24.0	16.0	100
Fats	76.5	12.0	11.5	None	100
Carbohydrates	44.0	6.0	50.0	None	100

Water.

Water, which forms nearly two-thirds of our bodies, is so important a constituent of both animals and plants, that we find it in large quantities disseminated throughout their structures.

Mineral Matters.

The mineral matters contained in both our bodies and foods are present in small quantities only.

Dietary.

It is fortunate that nature has provided these great varieties of food, so that man can make a selection suitable to his age, occupation, health, and other conditions of life. The subject of what are the proper proportions and kinds of food suitable to an economical and healthful diet covers too large a field for this series of articles; but it may be stated that people generally eat more than is requisite for the maintenance of their bodies in a state of perfect health.

The following table by Professor W. O. Atwater shows, in the form of debit and credit account, the daily income and expenditure of a man doing a moderate amount of work:—

Table III.—Assumed Daily Income and Expenditure of the Body of an Average Man doing a Moderate Amount of Muscular Labor.

INCOME.

Materials.		Weights.[1] Ounces.	Grams.
Nutrients of food.	Proteine	4.2	118
	Fats	2.0	56
	Carbohydrates	17.6	500
	Mineral matters	0.8	24
Water of food and drink		71.4	2,024
Oxygen of inhaled air		30.2	855
Total		126.2	3,577

OUTGO.

Materials.		Weights. Ounces.	Grams.
From digested food and inhaled oxygen.	Respiratory products excreted through lungs and skin.		
	Carbonic acid	38.8	1,100
	Water	12.7	361
	Excreted by kidneys.		
	Urea, etc.	1.2	34
	Mineral matters	0.7	20
Water otherwise excreted		71.4	2,024
Undigested matters (water free)		1.4	38
Total		126.2	3,577

[1] One pound avoirdupois, 453.6 grams; one ounce, 28.35 grams.

Various standards for daily dietaries for a man doing a moderate amount of work have been proposed by various authors, and the reader interested in such matters is referred to the last (third) edition of Dr. I. König's "Zusammensetzung der menschlichen Nahrungs und Genussmittel" (Berlin, 1889) for much information on the subject.

Below will be found a table,[1] prepared by Professor C. A. Meinert, giving the composition (in grams[2]) of the daily rations of the different European armies:—

Table IV.—Composition of the Rations of European Armies.

	Proteine.	Fat.	Carbo-hydrates.	Price.[1] Pfennig.	In the daily food as Meat, Raw.	Bread.
I. Imperial German Army						
Ordinary peace ration	107	22	489	33.4	150	750
Major " "	135	27	533	45 4	250	750
Ordinary field ration.						
Meat and bread	133	35	471	63.1	375	750
Pork " "	78	146	471	43 1	170[2]	750
Meat and biscuit	150	35	471	71 1	375	500[3]
Pork " "	97	146	471	51 1	170[2]	500[3]
Maximum ration	192	45	678	85 0	500	1000
II. Austria-Hungarian Army.						
In peace	100	51	474	40 0	187	900
In war.						
Meat	146	47	645	?	280	900
Pork	109	135	645	?	170[2]	714 meal; 100 bis'ct
III. French Army.						
In peace.	130	29	542	43	300	1000
In war						
Bread	139	31	574	48	312	1000
Biscuit	168	31	574	52	312	750[3]
Navy	136	44	478	46	330	750[3]
IV. Italian Army.						
In peace	127	45	613	57	300	918
In war	113	38	613	48	200	918
V. English Army.						
In peace	108	48	452	60	340	680
Navy						
Fresh meat	141	417		—	—	—
Salt "	165	535		—	—	—

[1] One mark equals 100 pfennigs, equal to 24 cents. [2] Pork. [3] Biscuit.

Digestibility of Foods.

The digestibility of foods is an important part of this subject, and it is to German chemists that we owe the greater part of our knowledge. The number of reliable investigations and experiments is very small, about sixty altogether, and the results obtained are tabulated in Table V.

Experiments in the digestibility of different cattle-foods have long been a subject of investigation by the different agricultural experiment stations in Europe, and the data obtained have been made use of in various ways, e.g., in quickly fattening cattle for the market.

The general method pursued consists in analyzing and weighing both the food consumed and the excreta; the latter representing the undigested materials, and the difference the amount digested. No trouble is found in feeding an ox or a horse on a diet of hay and water for a long period; but when a human being is taken for experiment, no matter how simple or palatable the food-material may be, it very soon becomes repugnant to him, the digestive functions are disturbed, and the accuracy of the experiment impaired. This is especially true where a diet of fat is tried.

[1] From König's Chemie der menschlichen Nahrungs- und Genussmittel (Berlin, 1889), p. 156.

[2] One gram equals 15.4 Troy grains; one ounce avoirdupois equals 28.35 grams.

Instead of the living subject, resort has been made to artificial digestion, when the food-material has been placed in a suitable vessel with a solution containing pepsin, and subjected, with occasional agitation, to the action of heat, at body temperature, for twenty-four hours, portions being taken out at different intervals and subjected to microscopical and chemical examination.

Table V.—Proportions of Nutrients Digested and not Digested from Food-Materials by Healthy Men (calculated by Professor Atwater).[1]

	Proteine. Total.	Proteine. Undigestible.	Fats. Total.	Fats. Undigestible.	Carbohydrates. Total.	Carbohydrates. Undigestible.	Mineral Matters.	Water.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Beef.								
Round	23.0	0.0	9.0	0.9	0.0	0.0	1.3	66.7
Sirloin	2[illegible].0	0.0	19.0	1.9	0 0	0.0	1.0	60.0
Pork, very fat	3.0	0.0	80.5	6.0	–	–	6.5	10.0
Haddock	17.1	0.0	0.3	–	0.0	0.0	1.2	81.4
Mackerel	18.8	0.0	8.2	0.8	0.0	0.0	1.4	71.6
Hen's eggs	13 4	0.0	11.8	2.4	0.7	0.0	1.0	73.1
Cow's milk	3.4	0.0	3.7	0.1	4.8	0.0	0.7	87.4
Cheese, whole milk	27.1	0.0	35.5	0.9	2.3	0.0	3.9	31.2
Butter	1.0	–	87.5	1.7	0.5	–	2.0	9.0
Oleomargarine	0.4	–	87.2	3.3	0.0	–	2 1	10.3
Sugar	0 3	–	–	–	96.7	0.0	0.8	2.2
Wheat-flour.								
Very fine	8.9	1.3	1.0	–	75.2	0.8	0.3	14.6
Medium	11.6	2.1	0.8	–	72.2	1.8	0.4	15.0
Coarse, whole wheat	10.9	2.7	1.8	–	71.7	5.3	1.2	14.4
Wheat-bread, average	8.9	1.2	1.9	–	55.5	0.6	1.0	32.7
Black bread	6.1	1.6	–	–	48.6	5.3	1.5	43.8
Pease	22.9	3.2	1.8	–	57.8	2.1	2.5	15.0
Corn-meal	9.1	1.2	3.8	–	71.0	2.3	1.6	14.5
Rice	7.4	1.2	0.4	–	79.4	0.7	0.4	12.4
Potatoes	2.0	0.5	0.2	–	21.3	1.6	1.0	75.5
Turnips	1.0	0.3	0.2	–	6.9	1.3	0.7	91.2

[1] Century, vol. xxxiv. p. 736.

From experiments made by Herr Jensen[1] in the laboratory of the University of Tübingen, it appears that raw meat is much sooner digested than cooked meat. The raw beef was digested in two hours; the boiled, "half done," was digested in two and a half hours; the boiled, "well done," was digested in three hours; the roasted, "half done," was digested in three hours; the roasted, "well done," was digested in four hours.

In regard to the relative digestibility of butter and oleomargarine, the only actual comparative tests on record are

[1] Century, xxxiv. p. 739.

a series made for three days on a man and a boy, by Professor A. Mayer, in Holland.[1] In these from 97.7 to 98.4 per cent of the fat of the butter, and from 96.1 to 96.3 per cent of the fat of the oleomargarine, were digested. The average difference was 1.6 per cent in favor of the butter. This proportion is so inconsiderable that in healthy persons it is of little or no importance. The slight difference in the chemical nature of the two fats would naturally lead to the same conclusion, as there is always a larger proportion of soluble glycerides in butter than in oleomargarine.

Dr. R. D. Clark made a series of artificial digestion experiments for the New York State Dairy Commission,[2] comparing oleomargarine with butter and other fats, including beef and mutton suet, and lard, cottonseed, sesame, and cod-liver oils. It was found from these tests that cod-liver oil exhibited the most perfect state of emulsion, after which came genuine butter, then "oleo" and lard oil, there being frequently no appreciative difference between them. The other animal fats and vegetable oils followed.

For healthy persons the difference between the genuine and artificial butter in digestibility was found to be nearly inappreciable. Cod-liver oil, which is the most readily digested of all the fats, cannot always be tolerated by invalids.

The difference between the digestibility of a piece of cold roast meat and oleomargarine would seem to be in favor of the latter, as the greater part of the more solid fats have been taken out of the latter in the process of manufacture; so that it more readily melts in the mouth and stomach, and from its fine state of division is readily emulsified.

Cooking.

Cooking, as far as animal food is concerned, has the effect of making it more pleasing to the taste, but is unnecessary; whereas with certain vegetables, especially those composed principally of starch, as grain and potatoes, it is required to fit them for use. The proper preparation of food is one that has not received the attention it demands. A badly cooked meal is more apt to disorganize the system than to prove nutritious and beneficial. The general teaching of cookery in our schools, both public and private, to girls would undoubtedly result in much improvement in this regard.

There is in boiling and frying foods a very simple problem in physics, which most people ignore; viz., that of latent heat. When a piece of meat, a vegetable, or other article of food, which is at the ordinary temperature, 60° to 75° F., is placed in boiling water or fat, the temperature of the solution is lowered proportionately to the mass and temperature of the article introduced; and it is not until the mass has absorbed more heat from the fire that the solution again comes to the boil. If care is taken, either by introducing the food in small quantities at a time into the boiling solution, so that very little lowering of the temperature takes place, or by a preliminary heating of the food before adding it to the solution, and in every case allowing the solution to boil before introducing any fresh material, the soddenness of improperly boiled or fried foods will be avoided.

Food-Products and their Chief Adulterants.

The great majority of substances used for food adulterants or substitutes consist of cheap and harmless substances, which are not injurious to health, as the following list of those most commonly met with in the principal food-products will show. This list has been compiled from the reports of the State boards of health, the returns of the British Inland Revenue Department, the reports of the British Local Government Board, and those of the Paris Municipal Laboratory.

[1] Landwirthsch. Versuchsstationen, 29, p. 215.

[2] Second Annual Report of the New York State Dairy Commissioner.

Table VI. — Food-Products and their Chief Adulterants.

FOOD-PRODUCT.	ADULTERANTS.
Milk	Water, removal of cream, addition of oleo-oil or lard to skimmed milk.
Butter	Water, salt, foreign fats, artificial coloring-matter.
Cheese	Lard, oleo-oil, cottonseed-oil.
Olive-oil[1]	Cottonseed and other vegetable oils.
Beer	Artificial glucose, malt and hop substitutes, sodium bicarbonate, salt, antiseptics.
Sirup	Artificial glucose.
Honey	Artificial glucose, cane-sugar.
Confectionery	Artificial glucose, starch, artificial essences, poisonous pigments, terra alba, gypsum.
Wines, liquors	Water, spirits, artificial coloring-matter, fictitious imitations, aromatic ethers, burnt sugar, antiseptics.
Vinegar	Water, other mineral or organic acid.
Flour, bread	Other meals, alum.
Baker's chemicals[1]	Starch, alum.
Spices[1]	Flour, starches of various kinds, turmeric.
Cocoa and chocolate	Sugar, starch, flour.
Coffee[1]	Chiccory, peas, beans, rye, corn, wheat, coloring-matter.
Tea	Exhausted tea-leaves, foreign leaves, tannin, indigo, Prussian blue, turmeric, gypsum, soapstone, sand.
Canned goods[1]	Metallic poisons.
Pickles	Salts of copper.

[1] For list of adulterated brands see Report of the Commissioner of Internal Revenue, 1889, pp. 181-184.

EDGAR RICHARDS.

NOTES AND NEWS.

EARLY this month there will be at the New York Academy of Medicine a joint discussion upon the pneumonias of this winter, by representatives of New York, Boston, and Philadelphia. Provost Pepper of the University of Pennsylvania has been appointed to represent Philadelphia. It is hoped that the discussion will lead to some positive conclusions as to the most effective method of dealing with *La Grippe*.

—At the meeting, on April 7, of the New York Academy of Sciences, Mr. George F. Kunz presented a paper on a remarkable find of meteorites in Kiowa County, Kan.

—The American Academy of Political and Social Science, organized in Philadelphia in December last, has met with unexpected success. It has already over three hundred members, though its working organization is scarcely two months old. Its membership list embraces many of the leading thinkers and workers in the economic and social field in this country and Canada. The first volume of its proceedings will appear early in June.

—At a meeting of the board of trustees of the University of Pennsylvania, held April 1, 1890, Dr. Hobart Amory Hare was elected clinical professor of the diseases of children, to succeed Dr. Louis Starr, resigned. Dr. Hare is a graduate of the University of Pennsylvania, 1884. He is a descendant of the distinguished Dr. Robert Hare, one of the early professors of the university. He has done much important original work, is a teacher of remarkable excellence, and, since his graduation in 1884, has won eight prizes for various essays, etc.

—The third national industrial exhibition of Japan opened at Tokio on April 1, and will continue until July 31. The directors of the exhibition have given special facilities for foreigners visiting their country, having made arrangements with railroad and steamboat lines for transportation all over the empire at a considerable reduction from the usual rates. These arrangements have been made by Mr. Iwamura Michitoshi, vice-president of the exhibition. Special tickets have been issued, entitling the bearer, on his arrival in Japan, to a passport which will enable him to travel through the empire. The exhibition includes a display of Japanese products and manufactures, art works, curios, etc.

—The St. Petersburg Academy of Sciences has issued the report for 1889, which was read at the annual meeting on Jan. 12. The report contains, according to *Nature*, a valuable analysis of the scientific work done by the members during the year. In mathematics, Professor Tchebysheff's applications of simple fractions to the investigation of the approximate value of the

square root, and M. Ishmenetsky's work on the integration of symmetrical differential equations, are especially worthy of note. In astronomy are to be noticed O. A. Backlund's researches on the influence of temperature upon refraction. In physics, M. Khwolson made an attempt at a mathematical investigation of the extremely complicated laws of dispersion of light in milk-colored glasses. The exploration of earth magnetism has made marked progress, both as regards the theory of diurnal variations and the measurement of magnetical elements in Caucasia and Siberia. Besides theoretical work in meteorology, the Central Physical Observatory has extended its system of weather-forecasts. Much interesting work has been accomplished in geology, Baron Toll having brought out the first volume of the geological part of the work of the expedition to the New Siberia Islands. In the botanical department the chief event was the publication of two parts of Professor Maximowicz's description of the plants brought from Central Asia by Prjevalsky, as well as the flora of western China, as represented in the valuable collections brought by M. Potanin. Highly interesting work was done in zoölogy by Professor Famintzyn.

— When the sun sets in the sea, a curious appearance, as of a bluish-green flame, is sometimes observed. This has been thought to be due to the light passing through the crests of waves. But Professor Sohncke, as we learn from *Nature*, considers this view disproved by such an observation as that recently made by Professor Lange at a watering-place on the Baltic. Shortly before sunset, the disk was divided in two by a thin strip of cloud; and, just as the upper part disappeared under the cloud, the blue flame was observed. Thus the cause appears to be in the air, not in the sea. It is a case of atmospheric refraction. And as a planet, seen near the horizon with a good telescope, appears drawn out into a spectrum, with the more refracted blue-violet end higher than the red, so the last visible part of the sun furnishes the blue-violet end of a spectrum. But it would be interesting, Herr Sohncke remarks, to determine more precisely the conditions of this not very frequent phenomenon. Perhaps it requires merely great transparency of air, as only in this case would the last ray be able to give a spectrum sufficiently intense in its blue region.

—Recently Lord Reay, the governor of Bombay, laid the foundation-stone at Poona of a bacteriological laboratory which is to be annexed to the College of Science in that town. Dr. Cooke, the principal of the college, to whose efforts the establishment of the laboratory is due, stated that it was originally intended that the study of the diseases of the lower animals in Poona should be directed to check the losses from anthrax in cattle by the introduction into India of protective inoculation. With this object, we learn from *Nature*, two Bengal students at the Cirencester Agricultural College underwent a course of study in M. Pasteur's laboratory in Paris. One of these gentlemen devoted his attention entirely to sericulture; the other studied M. Pasteur's system of vaccination against anthrax. He returned to India, and has since conducted some experiments on cattle in Calcutta. Subsequently Mr. Cooper, of the veterinary service, was deputed to M. Pasteur's institute for instruction in the system of inoculation against anthrax. While in Paris, Mr. Cooper submitted a report, and explained that for the work in question a special laboratory would be required. At the same time he advocated the adoption of artificial gas for the culture-stoves and glass-blowing, and for the purpose of obtaining the high temperature required for sterilizing vessels, instruments, etc. Subsequent inquiry showed that anthrax is not the only contagious disease of a fatal nature with which the Indian cattle-owner has to contend. He has also to take into account rinderpest, tuberculosis, pleuro-pneumonia, and, in a minor degree, foot-and-mouth disease. It was therefore evident that if an institution was established for the preparation of an anthrax vaccine, its value would be greatly enhanced if diseases other than anthrax could receive attention. The main objects of the Poona Laboratory, therefore, are (*a*) the preparation of anthrax vaccine for despatch to districts where anthrax prevails; (*b*) The conduct of experiments in rinderpest with a view to the discovery of the pathogenic micro-organism of the malady, its cultivation in broth and other media, and attenuation, so as to provide a vaccine that shall give immunity to animals in rinderpest-infected districts; (*c*) experimental research into the epizootic diseases generally of the ox and the horse; (*d*) the instruction of trained native veterinarians in a proper method of performing vaccination and of the precautions necessary to avoid risk of septic infection.

—A paper on forestry in India and the colonies was read recently by Dr. W. Schlich before the Royal Colonial Institute. He said, as given in *Nature*, that for seven hundred years a gradual destruction of forests of India had gone on. Under British rule, the process had been hastened by the extension of cultivated and pasture land, and by the laying-down of railways. After a time difficulty was experienced in meeting demands for timber, and in the early part of the century a timber agency was established on the west coast, while in 1873 a teak plantation on a large scale was made at Nilambur. Through the energy of a few officials, the matter was kept before the public; and in 1882, the Forests Department of Madras was entirely re-organized. Several acts were passed to provide for the management of the forests under the protection of the state, and a competent staff of officers was provided, to be re-enforced from time to time by those educated at Cooper's Hill College. Under the charge of the department were some 55,000,000 acres of forest-lands, and the figures relating to the cost of the work done were very satisfactory. Dr. Schlich then gave an account of the action of the Australian colonies with regard to the regulation of wooded lands by the state, contending that in no case had sufficient steps been taken to insure a lasting and continuous supply of timber.

—A preliminary report of the committee on anatomical nomenclature was accepted Dec. 28, 1889, by the Association of American Anatomists, without dissent. In this report the committee recommended (1) that the adjectives "dorsal" and "ventral" be employed in place of "posterior" and "anterior" as commonly used in human anatomy, and in place of "upper" and "lower" as sometimes used in comparative anatomy; (2) that the cornua of the spinal cord, and the spinal nerve roots, be designated as "dorsal" and "ventral" rather than as "posterior" and "anterior;" (3) that the costiferous vertebræ be called "thoracic" rather than "dorsal;" (4) that the *hippocampus minor* be called "calcar;" the *hippocampus major*, "hippocampus;" the *pons Varolii*, "pons;" the *insula Reilii*, "insula;" *pia mater* and *dura mater*, respectively "pia" and "dura." The committee, consisting of Joseph Leidy (chairman), Harrison Allen, Frank Baker, Thomas B. Stowell, Burt G. Wilder, and Thomas Dwight, desire frank and full expressions of opinion from scientific and medical journals, and from any who are interested in the subject. At the 1889 meeting of the American Association for the Advancement of Science, a report of that association's committee on anatomical nomenclature, with special reference to the brain, was made, to the effect that during the year some of the members of the committee have given to the subject intrusted to them as much time as their regular duties would permit. They agree upon one point; viz., the advantages, other things being equal, of mononyms (single-word terms) over polyonyms (terms consisting of two or more words). Before making specific recommendations or presenting a final report, the committee thought it advisable that they and other anatomists should have an opportunity of discussing at leisure the simplified nomenclature employed in certain treatises published during the winter. The treatises referred to in the above report are Leidy's "Human Anatomy," and the following articles in Wood's "Reference Handbook of the Medical Sciences," Vol. VIII.: by E. C. Spitzka, "Spinal Cord" and "Histology of the Brain;" W. Browning, "Vessels of the Brain;" S. H. Gage and B. G. Wilder, "Anatomical Terminology;" B. G. Wilder, "Anatomy of the Brain," "Malformations of the Brain," and "Methods of Dissection, etc." The members of the committee are Burt G. Wilder (chairman), Harrison Allen, Frank Baker, Henry F. Osborn, and T. B. Stowell.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.. .... $3.50 a year.

Great Britain and Europe................. 4.50 a year.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XV. NEW YORK, APRIL 11, 1890. No. 375.

CONTENTS:

HAS EVERY ONE A NATURAL CALLING?[1]

IT is not a rare occurrence to hear of a person that he has "missed his calling." People mean that his natural faculties and endowments are better fitted for other kinds of work than the one in which he is engaged. Here, then, we meet with the presumption that the person in question is especially well qualified for a particular occupation. Upon this presumption is based the meaning of the word "calling." He who is called to perform a certain kind of work or to fill an office is given credit for the qualifications it requires.

But let me ask, is there any such thing as a natural calling for every one? that is to say, is there in man a combination of faculties which qualifies him for a certain kind of activity, and for no other? Is he predestined, if I may use the term, to his calling, by the peculiar mixture of natural gifts he possesses?

The Germans are apt to answer this affirmatively. They maintain that every one is particularly well equipped by Mother Nature for one kind of activity, but that it is difficult to discover for which one, and that many persons fail in discovering it, choosing a field of occupation for which Nature has not intended them. In many cases their chosen profession or occupation is not the right one, which is illustrated in numerous cases. In truth, the fact that many pursue a calling in which they are not successful seems to indicate the strength of the argument. Yea, "to miss one's calling" was a proverb long before Bismarck characterized the journalists as men who had missed theirs.

In America we are apt to answer the question in the negative, and just as emphatically. The American will grant only in rare cases that a man may have a natural calling. Generally it is asserted that every one has the calling to earn his livelihood; and, as to the different kinds of human activity, our reverence for the self-made man prompts us to believe that every one is capable of doing any thing, provided he takes hold of it with pleasure and good-will.

Here, then, we have two opposite opinions, — on the one side, the German idea, that every one is equipped, that is, called for, a special kind of work, which idea has been developed in the most ideal manner, and defended by the ablest arguments; on the other side, the American idea, that every one may be or is prepared for or called to many, if not to all kinds of work. Which of the two ideas is correct, — either or neither of them? If neither, which one comes nearer the truth?

In order to answer these queries understandingly, it will be well to inquire into the origin of the two diametrically opposed ideas.

The Germans are an old nation, with a history and national culture of more than a thousand years. When first appearing upon the historic stage, they were divided into ranks, — in high and low nobility, free-born retainers, and serfs or servants, among whom were again distinguished body-servants and servants of the estate. When through war and strife, particularly in consequence of hostile invasions, it was found necessary for many to leave their isolated abodes, crowd together in cities, and live securely side by side behind ramparts, palisades, and town-walls, the social status of former times could not be retained. It was hard to give up privileges, for he who is in possession shuns the change; and it is proven in history that it is easier to yield an inborn right than to relinquish a privilege (a private right). But necessity knows no laws. The privileges of the free-born were disregarded in towns where all had to live together, side by side, and the will of the majority became law. The cities were populated, and soon became the very backbone of resistance to oppression and transgression of princes and nobles. In due course of time, inequalities vanished, and the citizens acquired equal rights, though not until after hard struggle and civil strife.

Even noblemen found it necessary to resort to some occupation where every one was obliged to make a living; and so we see families of great repute and noble name become merchants, armorers, etc. And just as among the Romans some trades were despised, we see in the cities of Germany that some occupations became honored, others despised and detested. The patriarchal government of those times soon regulated every thing, even the number of masters in each trade. Guilds sprang into existence, originally for the protection of their members, afterward for the exclusion of outsiders. Soon the guilds were sharply defined, and formed communities within the community. Even within the narrow confines of a guild numerous grades and subdivisions were established. There were tailor, carpenter, weaver, cobbler guilds, etc. Joiners and carpenters were not permitted to confound each other's work, any more than could nail-makers and blacksmiths, bricklayers and stonemasons. The cobbler who made men's boots and shoes was prohibited from making ladies' shoes: that was meddling with some one else's trade.

These guilds have a history of eight hundred years. Their pernicious influence upon culture and civilization is a matter of history, and need not be stated here; but it must be mentioned that they fostered the idea of seclusion and separation. They gave rise to the idea of a predestined calling for every one; and this idea became so predominant, that the accident of birth decided not only nationality and religion, but also the calling of the child; and to a limited extent this is still the case in our times.

In this country we ridicule the idea. Here the new-born child is not placed face to face with such an idea. He breathes the free air of a country which enjoys political and social liberty, as well as liberty of trade. In Germany the child seems to inherit the germ of the idea that his destiny is preconceived, and he inhales, figuratively speaking, an atmosphere which is fitted to develop this germ. A child of German parentage in America may inherit

[1] Paper read before the Anthropological Society in Washington, March 18, based on Professor Rohrbach's treatise on this question, by L. R. K.

the same tendency, but this tendency dies away under the influence of the unfavorable circumstances surrounding the child. Every thing here is opposed to it: the currents of American thought admit of no such presumption. The inherited tendency finds no nourishment whatever, and dies out.

That the guilds should have fostered the idea of predestination is evident. That the son should adopt the business of the father, in which he had grown up, the peculiarities of which he had known from early childhood, was something so self-evident, that the custom became an established rule.

Just consider this: the father's shop was ready for him to step into, material and goods were stored up, resources for this particular business and a market were found, custom was secured; in short, the father had warmed the nest so nicely, that the son would have been a fool to fly away into insecure circumstances to fight the hard battle for subsistence.

To all this came another powerful motive: liberty of trade, and the right to settle in any part of the country, are of very recent origin in Germany. Not only the guilds proved obstacles to the freest development of the nation's resources, but also the great number of independent and often antagonistic states and principalities and their governments. Though, through the peace at Muenster and Osnabrück at the close of the thirty years' war, two hundred of these petty states were wiped out of existence, there still remained more than three hundred and fifty of them up to the beginning of the nineteenth century; and every little fatherland had its own government and boundary posts. Not even the right to change one's domicile within these posts was readily granted. It was considered rank heresy, and an outrage upon time-honored custom, to speak of leaving; it was high treason to leave; and so the son staid where his cradle had stood. Of course, he spent a few years in travelling as journeyman, plying his trade under renowned masters; but soon he returned to the old nest.

This exclusiveness was particularly strict within the walls of the cities. Since their inhabitants had, by natural increase, filled the towns to overflowing, the city government prohibited outsiders from settling in town. The elders of the guild determined upon a certain number of masters who could ply their trade: no others were permitted to open a shop, lest competition might play havoc with their bread and butter. Even the sons of masters had to wait for the death of their fathers before they could start in business or become masters. As the number of inhabitants was literally limited by town-walls, so was the number of tradesmen by harsh, arbitrary rules. No wonder that hundreds, thousands, and hundred-thousands packed up and left, never to return.

To our own century it was reserved to remove the tyranny of guilds in Germany; and liberty of trade and settlement has only been secured by law during the last fifty years. This could never have happened if the cities had not first broken their choking neck-ring, — the town-walls, — and levelled their ramparts. It was a sequence of the marvellous change in warfare inaugurated by Napoleon I. Thus we see a beneficial sequence following the terrific influence of war. Such imposing armies as were massed together (1,300,000 soldiers went to Russia under command of Napoleon) made a mockery of town-walls and ramparts, built and thrown up before gunpowder was invented; and they were soon torn down and levelled by the citizens. After the restless little man Napoleon was safely stowed away as a prisoner on the Island of St. Helena, a time of peace of more than fifty years followed; and, lo! all the many buds broke open, and out of musty streets, and from behind mouldy town-walls, sprang an exuberantly blooming life in every domain of human exertion. Now additions from outside were welcomed in town. The cities swelled. The band that had checked their growth was torn asunder.

However, a state of things such as I have indicated had existed for more than eight hundred years, and had developed a certain mode of thinking and acting; had ripened certain deep-rooted prejudices; had imprinted upon life in Germany an almost indelible stamp; in fact, it had nurtured the idea of a natural calling for every one; and it need not be wondered at that there is still a strong current of thought in Germany which directs, or misdirects, the destiny and future of many a child.

Now turn to the Union. Here the people began, about two hundred years ago, where the Germans stand now. Here we never had town-walls, never any guilds, no limitation as to number and grade of practitioners of trade. Here we had no hostile neighboring nations lurking about to invade our territory and take us unawares. Free and unmolested, the people built their houses, towns, and cities, — built them upon the virgin soil under God's free heavens, without fear of sieges and scaling-ladders. Every one was permitted to come, and he was welcome to build; and if he thought he could earn his daily bread, he could do so without fearing any arbitrary limitations by guild regulations. Competition has ever been absolutely free in this country. The liberty of trade, like political liberty, has its own regulator. Trades and industries are governed by the steady force of the law of supply and demand, and the sleepless instinct of gain prompts us to heed that law.

The American farmer-boys of "ye olden time" (and they were greatly in the majority) were raised in a most excellent school, that of necessity. The great distances between the farm and the centres of trade made them lend a hand at almost every trade. They learned to repair shoes, wagons, and implements, to shoe horses, ply the carpenter's and joiner's trade, etc. They were not exclusively farmers. The idea that a man is predestined for one kind of labor, and for no other, never occurred to them.

The peculiarly advantageous circumstances of the New World for gaining wealth; constant immigration of skilled laborers from all civilized nations; a restlessness, which became permanent, caused by a constant westward movement of the people; the hope to enrich one's self still more quickly elsewhere, — these motives stirred all the powers of the nation into a mad whirl. A constant shoving and pressing, an unceasing roaming about and seeking luck, became the ruling passion of the people. The idea of taking root in a community rarely prompts any one here. Is he not the citizen of a country the extent of which is so great that it takes him six months to cross it on foot from east to west? Compare with such magnitude some small German principalities through which one could pass on foot conveniently in a day.

Now, when the American does not like one place, or if he fails to catch luck or to secure a fortune in one occupation, he simply turns to another; and so he changes readily from professions to trades or to farming, as circumstances seem to favor the one or the other. Since the people have never known town-walls or guilds, they do not entertain the idea that a man should devote his life to one thing exclusively. It is not at all astonishing to see a man shift from book-keeping to cigar-making, from farming to practising law or medicine, from working in a machine shop to doing this glorious country inestimable service as policeman or legislator.

We must not for a moment entertain the idea that this is conducive to great mischief. It is not: I rather think this freedom more beneficial than the humiliating bondage to which, according to the German usage, a man is condemned who has "missed his calling," and has to abide by the consequences of his folly. Let me repeat, liberty always has a regulator in itself. Free choice of occupation follows laws which are as unerring as the law of gravitation. No guild regulation could ever compete with them in effectiveness. Nature's law of the "survival of the fittest," though terribly cruel, is very effective.

And now we come back to our question, Is every person predestined for a calling? Approach the question regardless of preconceived notions, and you will have to consider that every one has his own peculiar face, his own form; each of his limbs or hands is peculiarly shaped, and cannot be duplicated by that of any other human being. His senses and faculties are in their combination so wonderfully and peculiarly arranged, that there may, perhaps, be found a similarity, but never an exact duplicate. This proves, if any thing, that no two men can be exactly alike in faculties, qualifications, tendencies, and accomplishments, so as to feel at any time, and under all circumstances, exactly the same impulse for action. Every one will move in a direction differing from that of all other men. Evidently, then, the peculiar mixture of which every individual consists tends toward confirming the belief that every one has a calling; that is, every person

must be specially well fitted for one kind of work, and for no other as well.

That would seem to settle the question, but it does so only apparently. The child is a "soft and yielding being." Plant-like, he accommodates himself to influences which play upon him. His aptitudes grow exuberantly on the one side, and become crippled on the other, as friendly or hostile influences prevail. A symmetrically shaped plant will become twisted and distorted if placed against a wall. It depends upon the treatment of the gardener, whether a tree will spend its energy in producing leaves or fruit. A boy six years old may have a talent for art, his sense of form and color may be very pronounced; yet after five years he may be found to have apparently lost that faculty, and developed in a direction which makes the observer prophesy that the boy will become a great lawyer. And, again, after some years he may be found to have developed great skill in manual occupation, having apparently pressed into the background his liking of art and literature.

These are no hypothetical cases. Every observant educator will have come to the conclusion ere this, that it is utterly unfruitful and perilous to fore-ordain a pupil's future. This being the case, it seems to me wise to follow the advice of eminent men; to wit, develop harmoniously all the talents that manifest themselves in the child, and leave the choice of occupation or calling to the developed and ripe judgment of the youth. Do not make this choice irrevocable. Give every one the greatest possible freedom for changing his profession, or occupation, or calling (or give it whatever name you will), if he comes to the conclusion that he missed it in his first choice. A human being who has had the chance and manifold opportunities for testing his natural gifts, and is permitted to exert himself in many directions, will certainly find his natural calling, and achieve great success. Let there be no arbitrary rules, no guild regulations, but let us maintain that liberty of action which has made this nation what it is, the greatest, noblest, most talented, most energetic, most successful, and therefore happiest, nation on the face of the earth.

HINDU ARITHMETIC.

EUROPEANS who have resided in India have frequently expressed astonishment at the rapidity with which arithmetical calculations are mentally made by very small Indian boys. Some account, therefore, of the Indian method of teaching arithmetic, which is believed to be superior to the English methods, is given by Frederic Pincott, M.R.A.S., in the April number of *Knowledge*, and will probably be interesting to our readers.

The arithmetical system of Europe was revolutionized by India when the so-called Arabic figures which we daily use were borrowed by Arab traders to the Malabar coast, and by them introduced into Europe. It was Indian intelligence which devised the method of changing the values of the numeral symbols according to their positions. This ingenious conception rapidly superseded the older methods, and gave enormously increased facility to arithmetical computations as compared with the Greek and Roman and the older Arabic methods.

In order to explain the present Indian system of arithmetic, it is necessary to premise that the *Pândhes*, or schoolmasters, employ a number of terms unknown to English teachers. These terms have been invented for the purpose of facilitating calculation, and the astonishing results achieved cannot be understood without comprehending the terms employed. The strangeness of the names of the figures and fractions arrests the attention of every student of Hindî. Few attempt to master the fractions; and there are some who, after many years' residence in India, cannot repeat even the numbers from one to a hundred.

Indians use monosyllables similar to ours, from 1 to 10; but from that point the words are built on the model of "1 and 10," "2 and 10," "3 and 10," etc.,[1] up to "8 and 10;" but the word for 19 means "minus 20." After 20 the same method is continued; "21" being impossible, the form is invariably "1 and 20," "2 and 20," up to "minus 30," "30," "1 and 30," and so on. This method of nomenclature goes back to remote antiquity, for the old Sanscrit language presents the same peculiarity.[1] The object of this nomenclature is to facilitate computation; for, in reckoning, the mind has to deal with the even tens, the simplest of all figures to multiply. Thus the question, "9 times 19," is not a simple one to an English child; but the Indian boy would be asked, "9 minus-twenties." In an instant he knows that he has only to deduct 9 minus quantities from 9 twenties, and the answer 171 comes before the English boy has fully realized the question. The formidable difficulty of the 9 is thus completely got rid of by a mere improvement in nomenclature.

[1] This is also the original meaning of the English words "eleven," "twelve," etc., up to "nineteen."

Another advantage that the Indian boy has is the use of short, mostly monosyllabic, terms for every ascent in the decimal scale; thus such lumbering expressions as "one hundred thousand" are unknown to him, the simple word *lâkh* conveying the idea fully to his mind. So, also, "one thousand millions" is *arb;* "one hundred thousand millions" is *kharb;* and so on. The advantages of this terseness must be at once apparent.

It is, however, with respect to fractional numbers that the advantage of the Indian system of nomenclature becomes most conspicuous, when once understood. They employ a large number of terms, which are given below.[2]

These terms are *prefixed* when used in combination with whole numbers, the object being to present the special modification to the mind before the number itself is named. Complicated as this nomenclature appears at first sight, its difficulties disappear when brought to the test of practice. It is the outcome of centuries of practical experience, and the thoughtful application of means to an end. It will be sufficient to illustrate the use of these words, and the extraordinary arithmetical facilities they afford, if the use of *paune* is explained, that is, $\frac{3}{4}$, that being the fraction which the English child has most trouble with. The Indian boy knows no such expression as "two and three-quarters;" in fact, the term "three-quarters" in combination with whole numbers has no existence in his language. His teacher resorts to the same device as has been explained when speaking of the figure 9: he employs a term which implies "minus." By this process $2\frac{3}{4}$ becomes *paune tîn*, that is, "minus 3," or "a quarter less 3;" and in the same way $3\frac{3}{4}$ is *paune châr*, that is, "minus 4;" and so on.

Precisely the same plan is adopted with reference to the term *sawâ*, which implies "one-quarter more:" thus $3\frac{1}{4}$ is *sawâ tin* = "plus 3;" $4\frac{1}{4}$ is *sawâ châr* = "plus 4;" etc. It will now be seen that the *whole* numbers form centres of triplets, having a minus modification on one side, and a plus modification on the other. This peculiar nomenclature will be clearly apprehended by the following arrangement: —

$2\frac{3}{4}$	paune-tin	-3	$3\frac{3}{4}$	paune-châr	-4	$4\frac{3}{4}$	paune-pânch	-5
3	tin	3	4	châr	4	5	pânch	5
$3\frac{1}{4}$	sawâ-tin	$+3$	$4\frac{1}{4}$	sawâ-châr	$+4$	$5\frac{1}{4}$	sawâ-pânch	$+5$

In multiplying these fractions, therefore, the Indian boy has to deal with only the minus and plus quantities. A simple instance will illustrate this. "7 times $99\frac{3}{4}$" would be a puzzle to an English child, both on account of its lumbering phraseology, and the defective arithmetical process he is taught to employ. The Indian boy would be asked, "*Sât paune-sau?*"—three words meaning "seven minus-hundreds?" The very form of the question tells him that he has only to deduct 7 quarters from 700, and he instantly answers $698\frac{1}{4}$. Equal facility is found with any similar question, such as "5 times $14\frac{3}{4}$?" The Indian boy is asked, "Pânch paune-pandrah?" i.e., "5 minus-fifteens?" As the words are uttered, he knows that he has only to deduct 5 quarters from 5 fifteens; and he answers at once, "Paune chau-hattrah," i.e., "a quarter less four and-seventy" ($73\frac{3}{4}$).

So much for the machinery with which the Indian boy works. The more it is understood, the more it will be appreciated. It is undoubtedly strange to our preconceptions; but it would be a

[1] In the ancient language there was also an optional form in conformity with the English method.

[2] Pâ,o = $\frac{1}{4}$; âdh = $\frac{1}{2}$; paun = $\frac{3}{4}$; paune = $-\frac{1}{4}$ ($\frac{1}{4}$ less than any number to which it is prefixed); sawâ = $1\frac{1}{4}$ ($\frac{1}{4}$ more than any number to which it is prefixed); sârhe = $+\frac{1}{2}$ ($\frac{1}{2}$ more than any number to which it is prefixed); derh = $1\frac{1}{2}$ (a number + half itself); pawannâ = $1\frac{3}{4}$; arhâ,î = $2\frac{1}{2}$ (twice and a half times any number); hûnthâ = $3\frac{1}{2}$; dhaunchâ = $4\frac{1}{2}$; pahûnchâ = $5\frac{1}{2}$.

real blessing to our country if corresponding suitable terms were invented, and this admirable system were introduced into all our schools.

Some Europeans have sought to account for the surprising results attained by Indian children, by attributing them to special mental development due to ages of oral construction. It is perfectly true that Indians rely more on their memories than on artificial reminders, and no one can come into contact with the people without being struck by their capacity for remembering. It is well known that many of the ablest men the country has produced could neither read nor write ; but they hardly missed those accomplishments, for their minds were frequently stored with more information, which was more ready to their command, than that possessed by the majority of book-students. It is well known that Ranjît Singh could neither read nor write, but he knew all that was going on in every part of a kingdom as large as France. He was an able financier, and knew at all times accurately the contents of all his treasuries, the capacities of his large and varied provinces, the natures of all tenures, the relative power of his neighbors, the strength and weakness of the English, and was in all respects a first-class administrator. We commit the mistake of thinking that the means to knowledge is knowledge itself. This induces us to give all the honor and prizes to reading and writing, and leads us to despise people, whatever their real attainments may be, who have not acquired the knack of putting their information on paper. It ought to modify our opinion on this point to reflect that the architectural triumphs of India were nearly all built by men who could neither read nor write. Another illustration of dependence upon memory instead of paper can be found in the Indian druggist, who will have hundreds of jars, one above another, from floor to ceiling, not one of them marked by label or ticket, yet he never hesitates in placing his hand on the right vessel whenever a drug is required. The same, to us, phenomenal power of memory is shown by the ordinary washermen, who go round to houses with their donkeys, and collect the clothes, some from one house, some from another. These they convey to the river and wash, and, in returning with the huge pile, never fail to deliver each particular article to its rightful owner.

The Indian boy's first task is necessarily to commit to memory the names of the figures from 1 to 100. He is next taught that there are nineteen places for figures, and their names. These correspond to our units, tens, hundreds, etc.; but the monosyllabic curtness in the names of the higher numbers is his distinct advantage.

What we call the multiplication table then begins. In England the multiplier remains constant, and the multiplicand changes: thus children repeat, "twice one, two; twice two, four; twice three, six;" etc. In India the boy is taught to say, "one two, two; two twos, four; three twos, six;" etc.; his multiplier changing, while the multiplicand remains fixed. Another peculiarity is this: he begins at 1, not at 2; and this furnishes him with a series of most useful collective numbers. Here, again, the English language lacks terms to translate the first table, but an idea may be gained from the following attempt: one unity, one; one couplet, two; one triplet, three; one quadrat, four; one pentad, five; etc.

These names for aggregates, as distinguished from mere numerals, are of much value to the boy in the subsequent processes, and give him another distinct advantage.

In learning these tables the boy is not carried beyond 10; that is, he goes no further than "two tens, twenty," "three tens, thirty," etc.; but to make up for that forbearance he is carried on in this process of multiplying figure by figure not only to 12, or up to 20, but he goes on through the thirties, and does not make his first halt until he gets to "ten forties, four hundred." In achieving this result something more than mere memory is brought into play, for he is taught to assist his memory by reference from one table to another; thus the first half of the six table is contained in the three table, etc.

A short supplementary table is next taught, beginning at 11×11 to 20×11, and then proceeding to 11×12 to 20×12, and so on up to 20×20. This method reduces considerably the tax on the memory; for one-half of the table is obviously the same as the other half, and therefore only half calls for special effort.

The boy has now committed to memory the multiplication of every figure from 1×1 to 20×20, and in addition he knows the multiplication of every figure up to 40 by the ten "digits." It will be observed that both tables end at 400 (10×40 and 20×20); in fact, 4 is the most important factor in Hindu arithmetic, all figures and fractions being built upon multiples and fractions of it.

At this point, instead of practising on imaginary sums in the hope of learning arithmetic empirically, the Indian lad immediately proceeds to tables of fractions, the first being the multiplication of every figure from 1 to 100 by $\frac{3}{4}$. Here, again, $\frac{3}{4}$ would be the last fraction we should attempt; but in India it is the first, and, by the superior system of nomenclature there in use, it is a very easy affair. The boy, knowing the multiplication of the whole numbers, is taught to deduct the half of the half ($\frac{1}{4}$), and the thing is done. Memory is assisted by observing that every multiple of 4 is a whole number, and that the number below it will always be a *sawâ* of the next lower figure, and the number above it always a *paune* of the next higher figure. Thus in answer to the question $\frac{3}{4} \times 36$, the Indian boy says mentally, 18, 9, 27; he also knows that 36 is the ninth multiple of 4, and by immediately deducting 9 can get his 27 that way also. Knowing, also, that 36 is a multiple of a 4 yielding 27, he knows that 35 will yield *sawâ chhabbîs* ($26\frac{1}{4}$), and that 37 will yield *paune athâ,îs* ($-28=27\frac{3}{4}$). In this way three-fourths of the table is a matter of logical necessity, resting on the elementary table previously acquired.

In the next table the boy is taught to multiply every figure from 1 to 100 by $1\frac{1}{4}$. This, of course, is precisely the reverse of the last: the $\frac{1}{4}$ is ascertained and added, instead of being deducted. Here, again, the multiples of 4 are whole numbers; but the figures preceding result this time in a *paune*, and those next following in a *sawâ*. This table also costs but little effort when thus taught.

The next table teaches the boy to multiply from 1 to 100 by $1\frac{1}{2}$, and of course means simply adding half the multiplier to the figure itself.

The next step, multiplying from 1 to 100 by $1\frac{3}{4}$, is achieved by simply adding three-quarters of the multiplier to the multiplier itself. The "three-quarters" table has been already acquired by the boy, and he has therefore only to add any given multiplier to it. Thus, if asked, "What is 27 times $1\frac{3}{4}$?" he knows that 27 *paunes* are $20\frac{1}{4}$: he has therefore only to add this to the 27 itself to get $47\frac{1}{4}$ as the instant answer.

The boy is next exercised in multiplying 1 to 100 by $2\frac{1}{2}$, and he is taught to do this by adding half the multiplier to the "twice-times" table.

Then follow similar tables multiplying by $3\frac{1}{2}$, $4\frac{1}{2}$, and $5\frac{1}{2}$; and the results are arrived at instantaneously by adding to the "three-times," "four-times," and "five-times" tables half the multiplier in every case.

In all these tables the rapidity and simplicity is in great part due to the terms employed. The boy is not asked to "multiply seventeen by three and a half," or "What is three and a half times seventeen?" or puzzled by any other form of clumsy verbosity. The terms he uses allow him to be asked "*sattrah hûnthe*" ("seventeen three-and-a-halfs"). His elementary table has taught him that $17 \times 3 = 51$, and he knows that he has only to add half 17 to that, and the sum is done.

The final task of the Indian boy is a money table, which deals with a coinage which may be thus summarized: 16 *damrî* = 1 *takâ;* 16 *take* = 1 *ânâ;* 16 *âne* = 1 *rûpî.*

There is a small coin called *dâm*, three of which make 1 *damrî;* and therefore 48 make 1 *takâ*, and 96 = *ânâ*, 4^2 being still the unit. The table imparts a familiarity in combining these coins together.

This completes an Indian boy's most elementary course of arithmetic; and a little reflection on the great facility for computation which Indian children show, and the simplicity of the means by which it is effected, ought to make us rather ashamed than boastful of our own defective methods.

HEALTH MATTERS.

The Influence of Cold on Pneumonic Infection.

DR. G. LIPARI of Palermo, in his recent experiments on the infectious nature of fibrinous pneumonia, essentially confirms what is known of Fraenkel's pneumonococcus, and has also succeeded in proving the influence of cold as a factor in the origin of fibrinous pneumonia. According to the *Lancet*, the endo-tracheal injection of pneumonic sputa or pleuritic exudation of animals which had died from pneumonococci gave a negative result; but when the author, before or after the endo-tracheal injection, exposed the animals to cold, the result was very different. Of eight animals so treated, six died with clearly established pneumonic infiltration. The author supposes that the cold paralyzes the ciliated ephithelium of the bronchi, and at the same time causes the mucous membrane to swell, both of which pathological processes favor the descent of the infectious material into the alveoli. These experiments were doubtless undertaken with a view to harmonize the old and new teaching upon the origin of this prevalent disease.

A Long Fall.

A remarkable fall of a miner down 100 metres of shaft (say, 333 feet) without being killed is recorded by M. Reumeaux in the *Bulletin de l'Industrie Minérale*. Working with his brother in a gallery which issued on the shaft, he forgot the direction in which he was pushing a truck: so it went over, and he after t, falling into some mud with about three inches of water. As stated in *Nature*, he seems neither to have struck any of the wood *débris*, nor the sides of the shaft, and he showed no contusions when he was helped out by his brother after about ten minutes. He could not, however, recall any of his impressions during the fall. The velocity on reaching the bottom would be about 140 feet, and time of fall 4.12 seconds; but it is thought he must have taken longer. It appears strange that he should have escaped simple suffocation and loss of consciousness during a time sufficient for the water to have drowned him.

Tight Collars and Vision.

The influence of tight collars in impeding the circulation in the head by pressing on the jugular veins is well-known to military surgeons with the troops in India, says the London *Lancet;* but the bad effects of such pressure in cooler climates have been demonstrated by the observations of Professor Förster of Breslau, who states that three hundred cases have come under his notice in which the eyesight has been affected by the disturbance of the circulation caused by wearing collars that were too small. A large number of these cases were probably subjects of myopia.

The Treatment of Phthisis by Carbonic Acid.

It is said that lime-burners enjoy a certain degree of immunity from phthisis, not because they take in more carbonic acid, but because its diffusion when expired is impeded. Again, the course of phthisis is often seen to be arrested in pregnancy, and this has been ascribed to the increased amount of carbonic acid in the maternal blood. Chronic heart-disease, by causing chronic hyperæmia of the lungs, also affords a kind of immunity against phthisis. Lastly, in emphysema there is also permanent dyspnœa in more or less degree, and the blood is overcharged with carbonic acid. Acting on these ideas, Dr. Hugo Weber (*Berliner klinische Wochenschrift*) proposes to administer carbonic acid by the stomach, in the form of effervescing powders. Ten cases are reported in which decided improvement was noted after this treatment, which certainly merits further trial, especially as it can be carried out at the patients' own homes. According to Ebstein's theory of diabetes, the increased proneness to phthisis which that disease entails is due to the defective development of carbonic acid, this being not only the final product of tissue oxidation, but a body which exerts a regulatory restraining influence on the destruction of glycogen and albuminoids. Bergeon, Dujardin-Beaumetz, and others, have used in phthisis gaseous injections *per rectum* of hydrofluoric acid, copiously diluted with carbonic acid, and the good results they met with are claimed by Dr. Weber as due to the diluent.

BOOK-REVIEWS.

Numbers Universalized: An Advanced Algebra. Part II. By DAVID M. SENSENIG. New York, Appleton. 12°.

THE volume forming the first part of this work was noticed in these columns last August. The work as a whole embraces all algebraic subjects usually taught in the preparatory and scientific schools and colleges of this country. The object in dividing the work into two parts is to accommodate all kinds and grades of schools sufficiently advanced to adopt its use. The work may be had bound either in one or two volumes, as may seem desirable to the teacher.

AMONG THE PUBLISHERS.

THE three latest issues of the *Modern Science Essayist*, Nos. 22, 23, and 24, are devoted to "The Evolution of the State," by John A. Taylor; "The Evolution of Law," by Rufus Sheldon; and "Evolution of Medical Science," by Robert G. Eccles, M.D.

—Two useful and convenient little pocket volumes just published by E. & F. N. Spon of London and New York are "Tables and Memoranda for Engineers," by J. T. Hurst (tenth edition), and "Practical Electrical Notes and Definitions," by W. Perren Maycock. The first-named volume, which is of vest-pocket size, contains memoranda for excavators, brick-layers, masons, carpenters, plasterers, iron-workers, plumbers, painters and glaziers, and others, besides tables on every subject connected with engineering. The other volume is intended to be a *vade-mecum* for all persons even remotely interested in electrical engineering. It treats, briefly but clearly, of wires and lightning-conductors; electrical circuits, units, and Ohm's law; magnets, batteries, bells, indicators, switches, and alarms; electric light and dynamos; the telegraph and telephone; the electrical transmission of power, electric motors, and telpherage. It also contains rules and regulations to be observed in the fitting-up of electrical installations, all diagrams necessary to make its subjects clear, and is provided with a very full index.

—"Giordano Bruno: Philosopher and Martyr," is the title of a pamphlet containing two addresses before the Contemporary Club of Philadelphia, and published by David McKay of that city. The first is by Daniel G. Brinton, and treats more particularly of Bruno's life, martyrdom, and character, though with some notice also of his philosophy. The second, by Thomas Davidson, is devoted almost exclusively to Bruno's doctrines, their nature, their history, and their present significance. Both authors show too strong a tendency to read their own opinions into Bruno's works, or at least to find anticipations of them even in his casual utterances, — a common fault in philosophical writers, at the present day, when treating of earlier thinkers. Bruno's philosophy is too vague and mystical to be identified with any of those now prevalent, though it has points of contact with several of them. Besides, what is most interesting in Bruno is not his philosophy, nor yet his personal character, which was not of the best, but his spirit of independent thought and his heroic resistance to ecclesiastical tyranny. For these he will be remembered and honored, whatever the defects of his character or his creed.

—The leading article in *Garden and Forest* last week is on the sugar-maple, and it is illustrated by a striking picture of one of these trees. The number also contains an illustration of *Syringa Pekinensis* (the so-called weeping lilac), with a description of this new shrub; while Dr. Maxwell T. Masters, the distinguished editor of the *Gardeners' Chronicle*, London, writes instructively on sports, and Professor Budd of the Iowa Agricultural College discusses hardy trees and shrubs. "Chrysanthemums," "Plants for Easter Decoration," "The Spring

Garden," "Faults in Grafting," and "The Longevity of the Elm," are titles of a few of the remaining articles.

—The University of Pennsylvania is about to begin the issue of a series of monographs representing work done in the fields of philosophy, psychology, and ethics. The first number is announced for April, and is a work on "Sameness and Identity," by Professor Fullerton. Following this number will be a series of studies from the laboratory of experimental psychology, and an edition of Descartes' "Meditations," with Latin and English texts, and philosophical commentary. The series will be published by the University of Pennsylvania Press, under the editorship of Professors Fullerton and Cattell. Dr. E. J. James, professor in the Wharton School of Finance and Economy, is preparing for the American Economic Association a paper on the "Canal Question in the United States." He will show how great a mistake the American people have committed in allowing its canal system to fall into decay. He is warmly in favor of the construction of a new system which shall unite the great water-ways of the West to the Atlantic seaboard at various points. Dr. Simon N. Patten, professor in the Wharton School of Finance and Economy, has in press a book entitled "The Economic Basis of Protection." He "re-examines the whole question of free trade *versus* protection in the light of modern economic theories, and shows how the free-trade theories are inconsistent with the best results of late economic thought."

Publications received at Editor's Office, March 24–April 5.

ALLEN, W. F. Ancient History for Colleges and High Schools. Part II. A Short History of the Roman People. Boston, Ginn. 370 p. 12°. $1 10.
BRINTON, D. G., and DAVIDSON, T. Giordano Bruno: Philosopher and Martyr. Two Addresses. Philadelphia, David McKay. 68 p. 12°.
CROSBY, H. The Seven Churches of Asia; or, Worldliness in the Church. London and New York, Funk & Wagnalls. 168 p. 16°. 75 cents.
GOULD, G. M. A New Medical Dictionary. Philadelphia, Blakiston. 519 p. 8°. $3 25.
HOLMES, O. W. Poems and Prose Passages from the Works of. Compiled by Josephine E. Hodgdon. Boston and New York, Houghton, Mifflin, & Co. 107 p. 12°. 30 cents.
MACARTHUR, R. S. The Calvary Pulpit. Christ, and him Crucified. London and New York, Funk & Wagnalls. 294 p. 12°. $1.
SUTTON, J. B. Evolution and Disease. New York, Scribner & Welford. 285 p. 12°. $1.25.
SWEET, H. A Primer of Phonetics. Oxford, Clarendon Pr. 113 p. 16°. (New York, Macmillan, 90 cents.)
WHITTIER, J. G., Poems and Prose Passages from the Works of. Compiled by Josephine E. Hodgdon. Boston and New York, Houghton, Mifflin, & Co. 112 p. 12°. 30 cents.
YOUNG, L. Simple Elements of Navigation. New York, Wiley. 226 p. 16°.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED—Position to teach Sciences or Mathematics by a Smith College graduate who was also a student at the Mass. Institute of Technology. Nine years' experience. Address T. H., care of SCIENCE.

A YOUNG LADY, graduate of Boston University, also of special course at the Massachusetts Institute of Technology, desires a position to teach Chemistry, Physics and Mathematics. Two years' experience. References given. Address MISS B. L., Warren, Mass.

A YOUNG MAN aged 19, a graduate of Eastman College, wants to serve an apprenticeship with some Manufacturing Electrical Laboratory where he can have access to books in evening. Is willing to work. The best of references given. C. F. BENEDICT, P. O. Box 84, Westbury, Wayne Co, N.Y.

AN experienced College Professor, with considerable ability in advertising educational institutions, now employed, is open to an engagement. Has built up two schools by advertising. Now is just the time to begin work for September opening. "William," 348 East 20th St., New York.

WANTED by a Cornell University graduate a position as Chemist in some Manufacturing establishment. References given. T. B.

A METALLURGICAL CHEMIST desires an engagement with a steel works, iron works, or blast furnace Has had nine years' experience in all branches of steel and iron work, and can furnish highest references and testimonials from former employers Address CHEMIST, 4,420 Chestnut St., Philadelphia, Pa.

A WILLIAMS SENIOR who has had two and one-half years' work in chemical laboratory, and one year in a biological laboratory, desires position as teacher of natural science and lesser mathematics, desires a position as instructor in these branches, or as assistant to some chemist. References as to ability and character. E. E. Towne, Box 74, Williamstown, Mass.

A REGULARLY graduated physician in his 32d year, who has been in active practice for eight years, excepting the time he was interne in a hospital and taking a post-graduate course, and who has done considerable work both in literature and science, more particularly connected with medicine, being now engaged in editorial writing for one of the first-class medical monthlies, wishes to learn of a town, not particular as to the size or location, where, in addition to practising his profession, he may become connected with a school or other institution as teacher of elementary and advanced physiology, chemistry, and hygiene, one or all; or would accept position with an older physician who is engaged in literary or scienific work, as an assistant, either in his practice, or as amanuensis or secretary, or in any capacity requiring knowledge of medicine and cognate branches; or would accept a position as librarian, having had experience as acting librarian while at college. Can furnish unexceptionable references as to ability and character, and, if the position offers opportunities for advancement, will accept for a time a nominal salary. Is married, but has no family beside his wife. Address Dr. W., care of *Science*.

WANTED—Books upon American Archæology. My publication, "Fort Ancient," in exchange. First-class standard works only. Warren K. Moorehead, Smithsonian Institution, Washington, D. C.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

Wanted—To furnish roots of *Dodecatheon Meadia*, *Sarracenia purpurea*, and other wild flowers, native of Southern Wisconsin, in quantities. D. E. Willard, Curator of Museum, Albion Academy, Albion, Wis.

A large number of plants from Maine, Connecticut, Indiana and Illinois for exchange. Southern and western exchanges preferred. Address, enclosing lists, L. N. Johnson, 223 Chicago Ave., Evanston, Ill.

For Exchange—Fourteen volumes Encyclopedia Britannica (Stoddard's ninth edition), bound in leather—part in original wrappers, all as new—can arrange to furnish volumes required to complete set, and six volumes "Am rican Naturalist" in numbers. Want small screw-cutting foot lathe and testing galvanometer and rheostat. For particulars address A. B. Campbell, McKean Co., Bradford, Pa.

To correspond with colleges, seminaries and other schools where cabinets of fossils and minerals are being collected. I have an extensive private collection of fossils from every geological period, and minerals illustrating the common and many of the rare forms. This collection is in duplicate, and the duplicates are for exchange or sale. Every thing is scientifically classified. W. A. Bronnell, professor of geology, 905 University Ave., Syracuse, N.Y.

I have a number of duplicates of microscopic slides, mostly botanical, which I would like to exchange for others not now in my collection. Send list of what you have to exchange and get my list. S. R. Thompson, New Wilmington, Pa.

Correspondence and exchanges solicited with persons interested in the study of American and Mexican antiquities. L. W. Gunckel, 36 Elm St., New Haven, Conn

I wish to exchange or purchase well-fixed or hardened vertebrate embryos for sectioning. Desire specially reptilian embryos, but will be glad to secure any material that I do not possess. Thomas G. Lee, M.D., Histological Laboratory, Yale University, New Haven, Conn.

Wanted—Books and journals, American or foreign, relating to Photography—exchange or purchase. C. W. Canfield, 1,321 Broadway, New York.

Wanted.—Marine univalves of the west coast, from U. S. line southward, and from Pacific Islands, offered; exchange from a general collection. — F. C. Browne, Framingham, Mass., Box 50.

CALENDAR OF SOCIETIES.

Anthropological Society, Washington.

April 1. — J. M. Gregory, Recent Find in Switzerland of Skeletons and Arms of the Old Roman Period; Garrick Mallery, The Origin and History of Salutations.

Women's Anthropological Society of America, Washington, D.C.

March 29. — Mrs. Anna H. Barus, Modern Socialism.

Appalachian Mountain Club, Boston.

April 9. — S. H. Scudder and others, The New Map of the Country about Boston; W. O. Crosby, Description of Mohegan Rock, Conn., and Comparison of it with the Madison Bowlder, New Hampshire (with lantern views of both); R. B. Lawrence, Account of the Winter Excursion to Randolph (with lantern views of the mountains and club hut).

American Academy of Arts and Sciences, Boston.

April 9. — J. Walter Fewkes, The Use of the Phonograph in the Preservation of the Languages of the American Indians, with Demonstrations.

Engineers' Club, St. Louis.

April 2. — Thomas Long, The Erection of Some Recent Large Bridges; Mr. Frank Nicholson, The Pemberton Concentrator (read by Mr. Arthur Thacher).